What is claimed is:

1. A system for controlling fluid flow through i lines, wherein the i lines are connectable through tubing to i zones, respectively, and wherein $i = 1, 2, \ldots, N$, the system comprising:

at least one valve in each of the i lines;

a pressure transducer operatively connected to each of the i lines;

a first input device for receiving properties of the system;

a zone pressure estimator connected to the pressure transducers and the first input device and programmed to, for each of the i lines, receive a measured pressure in the flow line $\underline{i}$ from the pressure transducer, receive from the first input device properties of the system, and calculate a pressure estimate of the zone i;

a second input device for receiving a pressure set point for each of the i zones,

a control device connected to the valves of the lines i, the zone pressure estimator and the second input device, and programmed to,

receive the pressure set point for the zone i from the second input device,

receive the pressure estimate of the zone i from the zone pressure estimator, and

compare the pressure set point for the zone *i* to the pressure estimate of the zone *i*, and, if the estimate does not equal the set point, operate the valve of the lines *i* until the estimate equals the set point.

2. A system according to claim 1, further comprising a pressure manifold connected to inlets of the *i* lines.

3. A system according to claim 1, further comprising a vacuum manifold connected to outlets of the *i* lines.

4. A system according to claim 1, wherein the valve of each of the *i* lines includes an inlet valve for connecting a pressure source with the line and an outlet valve for connecting a vacuum source with the line, and wherein the control device is connected to the inlet valves and the outlet valves and is programmed to operate the inlet and the outlet valves of the lines *i* until the pressure estimates equal the pressure set points.

5. A system according to claim 4, further comprising a pressure source connected to the inlet valves.

6. A system according to claim 5, further comprising a pressure manifold connecting the pressure source to the inlet valves.

7. A system according to claim 4, further comprising a vacuum source connected to the outlet valves.

8. A system according to claim 7, further comprising a vacuum manifold connecting the vacuum source to the outlet valves.

9. A system according to claim 8, wherein the vacuum manifold includes a venturi.

10. A system according to claim 1, wherein the i zones have rigid walls.

11. A system according to claim 1, wherein the i zones have flexible walls.

12. A system according to claim 1, wherein the i zones are coupled.

13. A system according to claim 1, wherein the i zones are non-coupled.

14. A system according to claim 1, wherein the first input device comprises a keyboard.

15. A machine including the system of claim 1 and further including i zones connected through the tubing to the i lines, respectively, wherein $i = 1, 2, \ldots, N$.

16. A machine according to claim 15, further comprising a machine control device connected to the second input device and programmed to provide the pressure set point for each of the i zones of the machine.

17. A machine according to claim 15, further comprising a CMP carrier head containing the i zones.

18. A machine according to claim 17, wherein the zones of the carrier head are formed at least in part by flexibly resilient bladders.

19. A machine according to claim 18, wherein the zones of the carrier head press against one another.

20. A system according to claim 1, wherein the properties of the system include constants ($C_{tube,i}$ and $\tau_{tube,i}$) associated with the tubing connecting the line $\underline{i}$ to the zone $\underline{i}$, a volume ($V_{z,i}$) of each zone $\underline{i}$, an initial volume ($V_{z0,i}$) of each zone $\underline{i}$ under STP conditions, a

volume expansion/contraction time constant (τ_v), an expansion/contraction coefficient (γ_{ii}) of zone i, and a coupling coefficient (γ_{ij}) between zone i and zone j.

21. A system according to claim 20, wherein the pressure estimator is programmed to calculate an nth sample of the pressure estimate of the zone i, $\hat{P}_{z,i}^{(n)}$, where n is time dependent and,

$$\hat{P}_{z,i}^{(n)} = \hat{P}_{z,i}^{(n-1)} + \Delta t\left(\frac{P_{STP}}{\hat{V}_{z,i}^{(n)}}\hat{Q}_{z,i}^{(n)} + \frac{\hat{P}_{z,i}^{(n-1)}}{\tau_v \hat{V}_{z,i}^{(n)}}\left[\hat{V}_{z,i}^{(n)} - V_{z0,i} - \gamma_{ii}(\hat{P}_{z,i}^{(n-1)} - P_{STP}) - \sum_{i\neq j}\gamma_{ij}(\hat{P}_{z,i}^{(n-1)} - \hat{P}_{i,j}^{(n-1)})\right]\right),$$

$$\hat{Q}_{z,i}^{(n)} = \frac{\hat{Q}_{z,i}^{(n-1)} + \Delta t C_{pipe,i}(P_{b,i}^{(n)} - \hat{P}_{z,i}^{(n-1)})}{\left(1 + \frac{\Delta t}{\tau_{pipe,i}}\right)}, \text{ and}$$

$$\hat{V}_{z,i}^{(n)} = \frac{\hat{V}_{z,i}^{(n-1)} + \frac{\Delta t}{\tau_v}\left[V_{z0,i} + \gamma_{ii}(\hat{P}_{z,i}^{(n-1)} - P_{STP}) + \sum_{i\neq j}\gamma_{ij}(\hat{P}_{z,i}^{(n-1)} - \hat{P}_{z,j}^{(n-1)})\right]}{\left(1 + \frac{\Delta t}{\tau_v}\right)},$$

and

where P_b is the measured pressure, and

wherein the control device is programmed to receive an nth pressure set point for each of the i zones from the second input device, receive the nth sample of the pressure estimate for each of the i zones from the zone pressure estimator, and compare the nth pressure set point for each of the i zones to the nth sample of the pressure estimate of the zone i, and, if

the *n*th sample does not equal the *n*th set point, operate the valve until the sample equals the set point.

22. A method for controlling fluid flow through *i* lines, wherein the *i* lines are connectable through tubing to *i* zones, respectively, and wherein $i = 1, 2, \ldots, N$, the method comprising:

receiving a measured pressure in the flow line;

receiving properties of the system;

calculating a pressure estimate of the zone *i* based upon the properties of the system;

receiving a pressure set point for each of the *i* zones; and

comparing the pressure set point for each of the *i* zones to the pressure estimate for each of the *i* zones, and, if the pressure estimate does not equal the set point, modifying flow through the flow line *i* until the pressure estimate equals the set point.

23. A method according to claim 22, wherein the *i* zones have rigid walls.

24. A method according to claim 22, wherein the *i* zones have flexible walls.

25. A method according to claim 22, wherein the *i* zones are coupled.

26. A method according to claim 22, wherein the *i* zones are non-coupled.

27. A method according to claim 22, wherein the properties of the system include constants ($C_{tube,i}$ and $\tau_{tube,i}$) associated with the tubing connecting the lines to the zones i, a volume ($V_{z,i}$) of each zone, an initial volume ($V_{z0,i}$) of each zone under STP conditions, a volume expansion/contraction time constant (τ_v), an expansion/contraction coefficient (γ_{ii}) of zone i, and a coupling coefficient (γ_{ij}) between zone i and zone j.

28. A method according to claim 27, wherein an nth sample of a pressure estimate of the zone i, $\hat{P}_{z,i}^{(n)}$ is calculated, where n is time dependent and,

$$\hat{P}_{z,i}^{(n)} = \hat{P}_{z,i}^{(n-1)} + \Delta t\left(\frac{P_{STP}}{\hat{V}_{z,i}^{(n)}}\hat{Q}_{z,i}^{(n)} + \frac{\hat{P}_{z,i}^{(n-1)}}{\tau_v \hat{V}_{z,i}^{(n)}}\left[\hat{V}_{z,i}^{(n)} - V_{z0,i} - \gamma_{ii}(\hat{P}_{z,i}^{(n-1)} - P_{STP}) - \sum_{i\neq j}\gamma_{ij}(\hat{P}_{z,i}^{(n-1)} - \hat{P}_{i,j}^{(n-1)})\right]\right),$$

$$\hat{Q}_{z,i}^{(n)} = \frac{\hat{Q}_{z,i}^{(n-1)} + \Delta t C_{pipe,i}(P_{b,i}^{(n)} - \hat{P}_{z,i}^{(n-1)})}{\left(1 + \frac{\Delta t}{\tau_{pipe,i}}\right)}, \text{ and}$$

$$\hat{V}_{z,i}^{(n)} = \frac{\hat{V}_{z,i}^{(n-1)} + \frac{\Delta t}{\tau_v}\left[V_{z0,i} + \gamma_{ii}(\hat{P}_{z,i}^{(n-1)} - P_{STP}) + \sum_{i\neq j}\gamma_{ij}(\hat{P}_{z,i}^{(n-1)} - \hat{P}_{z,j}^{(n-1)})\right]}{\left(1 + \frac{\Delta t}{\tau_v}\right)}, \text{ and}$$

where P_b is the measured pressure, and

an nth pressure set point for each of the i zones is received and the nth pressure set point for each of the i zones is compared to the nth sample of the pressure estimate of the zone i, and, if the nth sample does not equal the nth set point, flow through the flow line is modified until the sample equals the set point.

29. A system for remotely controlling pressure within each of *i* zones by controlling corresponding pressure within each of *i* lines respectively connectable to the *i* zones, wherein *i* = 1, 2, . . . , *N*, the system comprising:

at least one control valve connected to control the flow of fluid through each line;

a pressure transducer connected to measure the pressure in each line;

a zone pressure estimator connected to each pressure transducer and programmed to, for each of the *i* lines, receive a measured pressure in the flow line *i* from the pressure transducer, and calculate an estimated pressure within the zone *i* as a function of predetermined characteristics of the system and the measured pressure provided by the pressure transducer; and

a control device connected to each valve of the corresponding line *i* and the zone pressure estimator and programmed to operate the valve so as to control the flow of fluid in the corresponding line *i* as a function of a pressure set point and the estimated pressure within the zone *i* from the zone pressure estimator.

30. A machine including the system of claim 29 and further including *i* zones respectively connected to the *i* lines.

31. A machine according to claim 31, further comprising a machine control device connected to the control device and programmed to provide the pressure set point for each of the *i* zones of the machine.

32. A machine according to claim 31, further comprising a CMP carrier head containing the *i* zones.

33. A machine according to claim 32, wherein the zones of the carrier head are formed at least in part by flexibly resilient bladders.

34. A machine according to claim 33, wherein the zones of the carrier head press against one another.

35. A method of remotely controlling pressure within each of i zones by controlling corresponding pressure within each of i flow lines respectively connectable to the i zones, wherein $i = 1, 2, \ldots, N$, comprising:

controlling the flow of fluid through each line with at least one control valve;

measuring the pressure in each line;

calculating an estimated pressure within the zone i as a function of predetermined characteristics of the system and the measured pressure in the corresponding flow line i; and

operating the valve so as to control the flow of fluid in the corresponding flow line i as a function of a set point and the estimated pressure within the zone i.